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CMCC Doc. No. 1131X5.67
Copy 1 of 4
Page 1 of 6

Encl #3
SAPC 12800
COPY 1 OF 3

Proposal: CAN 46
January 10, 1957

STATEMENT OF ADDED WORK
3-CHANNEL DATA REDUCTION EQUIPMENT FOR SYSTEMS 1 AND 3

The Contractor has had to supply added engineering, services, and material to perform the following work in addition to that originally proposed for the 3-channel data reduction system for use with Systems 1 and 3 magnetic tape recordings:

1. Mixing and Output Control Chassis (A and C Racks)

The complexity of the function performed by the mixing and output control unit chassis in the "A" and "C" racks required that it be designed as a separate unit in the playback equipment. This chassis requires a number of circuit additions, including twelve cathode followers, an audio monitoring amplifier, and electronically regulated power supply (high regulation is required to eliminate crosstalk).

2. Master Power Switch Unit (All Racks)

A master power switch unit was added to the playback rack (A rack) to control the application of power to the assembled equipment in such a way that system operation is facilitated. In addition to providing system power control, this unit also provides an alarm and automatic shut-down of the system under such conditions as breakage of magnetic tape, or when the strip-chart supply is consumed. Automatic switching circuits have been added in the master power switch unit and circuit modifications were required in other units of the system, such as in the tape transports and event-marker, as a part of this function.

Power switch units were added to each rack individually to control the application of power to the equipment in such a way that flexibility of use would be maintained. Individual racks can be operated from either the central source on the master power switch unit or from separate sources of power. Circuit breaker protection and appropriate signal light indication is provided in both cases.

Proposal: CAN 46
January 10, 1957

In conjunction with the control feature, additional wiring within each rack and cabling between separate racks is required.

3. Playback Amplifier (A and C Racks)

A number of additions and changes were made in the playback amplifiers and associated assembly. These are as follows:

a. An input switching circuit was added to the monitor chassis which greatly extends the flexibility of operation by permitting the connection to the amplifier input terminals of any of the following:

(1) playback heads from either of two playback transports.

(2) playback heads from any one of four duplicating transports. This greatly extends flexibility of operation, permitting the duplicating recorders to be used in a playback capacity, in addition to their normal function as duplicators.

(3) test jacks accessible at the control panel. This facilitates amplifier testing and also provides auxiliary input terminals.

(4) ground. This provides a quick check of amplifier noise level.

Considerable chassis and rack wiring was required by the above additions.

b. An integrating circuit was added to the amplifier in order to compensate for the playback head response, thereby improving the overall reproduction fidelity.

c. Circuit additions were made in order to obtain an improved signal-to-noise ratio. A high-pass filter, a low-pass filter and a parallel-T, R-C filter were added.

4. Transport Sequence Control (B-2 Rack)

A number of minor additions were made to the transport sequence control, such as a pulse stretcher which provides insurance against self-triggering of the aural readout control circuit, and time delay circuits which prevent transients during warmup and switching operations from causing unstable operation. The aggregate of these changes amounted to an increase in the bulk and complexity of the transport sequence control, with the result that the power supply for this unit was constructed as a separate unit.

5. Time-Mark Generator Unit (A Rack)

Several additions were made to the time-mark generator unit as follows:

a. To accommodate the small variation in the 1-kc tone resulting from the tolerance in the recording speed of the airborne recorder, the original filter was replaced by three narrow-band filters selectable by a manual switch. To increase selectivity, each of these band-pass filters utilized two stages instead of a single stage formerly used in the original circuit.

a. (Continued)

A similar adjustable filtering circuit was provided for selecting the 4 kc tone.

b. Additional R-C filtering was also added on the reset bus and on the one-minute output bus to eliminate spurious triggering of the counters.

c. As a result of a change in the method of use of associated operational equipment, the one-minute markers in the 1-kc tone of the original tape recordings did not prove to be accurately spaced at one-minute intervals and were unsatisfactory for time reference purposes as originally planned. It was necessary to base the time to start, stop, and back up the tape transports during the automatic cycling operation upon a signal derived from a count of the time-reference tone rather than upon the markers on the tone. These changes involved scrapping work already completed and modifying the time-mark generator unit to provide a suitable timing device. Additions to the power supply requirements were also necessitated by this modification.

6. Data Separator Unit (F Rack)

Signal amplification was required to insure reliable writing action on the strip-chart. A separate amplifier was added for each of the eighteen event-marker stylii. Each of the five filter circuits also required circuitry changes and a cathode follower buffer to increase selectivity and sensitivity. The power supply requirement for this unit was increased considerably.

Proposal: CAN 46
January 10, 1957

7. Time Display Unit (F Rack)

The change in method of timing described in paragraph 5c above resulted in circuit revisions in the time display unit. Minute, ten-minute, and hour marks, originally derived from the minute markers on the time-reference tone, are now derived by the use of a counting chain driven by the time reference tone itself.

The counter circuit was complicated by the requirement to store an accumulated count for display. The addition of storage, transfer, and clearing circuits were required.

Because of the above additions and also the additions (ref: item 6, page 4) to the data separator unit, the time display unit was incorporated as a separate chassis assembly.

8. Modification for Two Moving Stylii (F Rack)

A modification has been requested by the Customer to the event-marker unit to install two stylii, 2 stylus motors, and two channel amplifiers in order to permit an indication of the amplitude of signals recorded on the two data channels of the magnetic tape record to be displayed on the event-marker strip chart. This modification is described in more detail in the accompanying Technical Exhibit CMCC Doc. No. 1133X5.16.

9. Event-Marker Unit (F Rack)

Because the commercially available Alden Event-Marker proved to be inadequate for the intended purpose, the design and construction of a suitable Event-Marker was undertaken. The resulting unit was far more reliable mechanically and contained features not present in the Alden unit.

10. Modification to Event-Marker Rack for Compatibility with System 4 Equipment (F Rack)

To make the event-marker rack compatible with the 14-channel data reduction racks a number of changes were required. Connectors had to be added to the back of the rack and internal wiring installed. Circuitry and wiring had to be added to modify the timing function so that it would operate from a one-minute mark supplied by the K Rack in place of the one kilocycle tone previously used for the timing function.

11. Additions to Technical Manuals

Substantial increases in scope and additions to the technical manuals have been necessitated by the increased complexity of the data-reduction equipment.

In addition to the above specific changes, there were increases in the complexity of the construction of the racks to incorporate the described changes. Additional labor and purchased services were required for packing the racks for shipment, and these costs had not been included in the original estimate.